

How to Analyze That Problem

By PERRIN STRYKER

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How to Analyze That Problem

Part II of a management exercise

By Perrin Stryker

Part I of this two-installment article on problem analysis, published in the May-June issue of HBR, invited readers to test their reasoning powers against the problems presented in a case history based directly on an actual situation. This case was reported to Kepner-Tregoe and Associates, whose systematic approach to problem analysis, as described in this installment, made possible the correct solution of a very puzzling situation.

Before resuming the action, I will first give a brief synopsis of what has transpired in the first installment and then introduce the characters who appear in this concluding part (all but one of whom appeared in Part I).

The Situation

In a plant making quarter panels and other parts for one of the Big Three auto companies, the Plant Manager and three of his key subordinates are trying to find out why burrs and rough spots are suddenly appearing on so many panels, causing them to be rejected. They strongly suspect deliberate sabotage by the men on the production lines, who are reported to be angry over the suspension of worker Joe Valenti by a hot-headed supervisor, who accused him of drinking on the job. The shop steward threatens to call a strike if the supervisor is not reprimanded for his arbitrary action and also if Valenti is not reinstated.

The Plant Manager collects as many facts as he can in a meeting with his key subordinates, and then adjourns the meeting until the next morning. In the meanwhile, he hopes he can decide what to do. He sees two alternatives: back up the supervisor and risk a strike that might be stopped by injunction; or avoid a strike by undercutting the supervisor, reinstating Valenti, and asking the men on the line to cooperate in eliminating the excessive rejects. The Plant Manager hopes that he can find another, better alternative, however, before the second meeting with his managers.

The Principals

The following short descriptions of the characters who appear in this second part of the article (the names are disguised) may be useful:

- *Oscar Burger, Plant Manager — a tough manager in his late fifties; known for his willingness to listen to others; considered antiunion by the employees.*
- *Robert Polk, Production Chief — a hard-nosed driver, very able technically, but quick-tongued and inclined to favor certain subordinates; also considered antiunion by the employees.*
- *Ben Peters, Quality Control Manager — reserved, quiet, and cautious when dealing with others; extremely confident in his figures.*
- *Ralph Coggin, Industrial Relations Manager — a fairly typical personnel manager; sympathetic to employees; relies on human relations techniques in dealing with the union.*

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- *Tom Luane, Scheduling Supervisor — persistent, analytical, and systematic; has had some training in problem analysis procedure, but lacks experience.*

Problem Analysis

The situation for Part II of this case opens at 9:30 a.m. on Thursday in the office of Plant Manager Burger (the next-morning meeting).

BURGER: Before we begin this morning, you notice I've asked Tom Luane, our Scheduling Supervisor, to sit in with us. He's just returned from taking a five-day course in problem solving and decision making, and I thought this would be a good chance to see if he's really learned anything. Now then, Ben, let's hear about those reject rates on the panels. How do they look this morning?

PETERS: They're still way over our 2% tolerance on lines #1, #2, and #4. If anything, they're a bit higher than yesterday.

BURGER: Hasn't Line #3 begun to foul up a lot of panels yet?

PETERS: No signs of it, Oscar.

BURGER: Bob, did Engineering check out the stamping press on Line #3? You know we wanted to track down that rumor about the stamping job on the Cheetah panels being easier than on the Panther panels.

POLK: Engineering says it's strictly rumor — there's absolutely no difference in the stamping time required on any of the four lines.

BURGER: Damn . . . I thought that we might have traced this reject trouble to the presses somehow.

COGGIN: You still can't say that the men on lines #1, #2, and #4 don't feel that the work on Dawson's Line #3 is easier; and if they think Dawson's men have been favored by getting the Cheetah panels, there could be something in it.

BURGER: But Engineering says no, Ralph. We can't psychoanalyze the men to find out why they believe this, if they really do. More to the point, what did you find out about that wash-up time deal the local union agent plans to ask us for?

COGGIN: Shop Steward Patella says he'll be glad if the men get this extra time, but he still demands that Valenti be reinstated and that Supervisor Farrell be reprimanded. I don't think Patella would back down even if his local agent told him not to threaten a strike. And the men really seem sore enough to walk out on us.

BURGER: All right, then, that settles it. I've made up my mind. Since we've got to avoid a strike at all costs, with Detroit hounding us for all the panels we can ship, we're going to reinstate Valenti, reprimand Farrell, and also jack up the other supervisors so they'll catch any man trying to produce rejects deliberately. Then we'll ask the men to cooperate in keeping the reject rates within our tolerance. You, Ralph, will tell Patella that if we catch him inciting the men to sabotage the production lines by buring a lot of panels — just in the hope of getting a hot issue for the new contract negotiations — then we'll charge him and his union with this before the NLRB. If they threaten us with a strike, we'll get an injunction to carry us at least over the next two months of maximum output.

POLK: I'm real glad to hear you take a strong line on this, Oscar. We've been too soft with that union for a long time, in my opinion. But I don't think you ought to reprimand Farrell and reinstate Valenti. That could hurt all our supervisors.

BURGER: Sorry, but that's it, Bob. Farrell was too rash in suspending Valenti without any evidence. We've got to calm the men down and stop this damned buring trouble, or we'll have Detroit on our necks, and hard!

COGGIN: I think you're doing just right, and I'm sure the men on the lines will cooperate in licking this reject problem.

BURGER: I hope so. Anyway, I can't see a better decision at this time. (*He turns to Luane.*) Now, Tom, how did we do? What do you think of our problem solving and decision making?

LUANE: I can't really say, Mr. Burger, because I'm not at all sure just what the problem is.

BURGER: Well, it started out as a reject problem and then developed into a touchy union situation we've had to handle.

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POLK: The basic problem, Tom, is discipline in the shop. We've been too lax with the men and too soft with the union.

COGGIN: I'd say the real problem is our need to train the supervisors in their responsibilities. Also, we've got a communications problem if a supervisor like Farrell fails to get the message that he must notify me before taking disciplinary action.

LUANE: Let's see . . . that makes six problems you have mentioned — rejects, union antagonism, shop discipline, lack of supervisory training, low morale, and poor communications.

BURGER: Yes, but you could say they're really all part of one whole problem, as I see it.

LUANE: One whole problem? What's that? From what I heard, it sounds like you've got a mess of problems here.

BURGER: What I mean by the whole problem is managing this entire plant so everything runs on schedule and putting out what Detroit wants. Did they teach you how to solve that kind of problem in your training course?

LUANE: Not exactly. But I did learn the difference between a problem and a decision, and I think some of you have been mixing these two things up, from what I have heard.

Defining the Problem

Let us pause here for a moment and see what these managers have been doing. First, Plant Manager Burger checked on the points of information he'd asked for at the previous meeting, and these satisfied him that he was right in assuming sabotage to be the cause of the high reject rates on the panels. He then made several decisions which he judged capable of taking care of both the reject problem and the labor difficulties.

Some of Burger's decisions seem right to Production Chief Polk, who only disputes Burger's handling of Farrell and Valenti; and all seem right to Industrial Relations Manager Coggins, who accepts Burger's reasoning completely.

Then Scheduling Supervisor Tom Luane begins to ask some pertinent questions and finds that each manager is using the word "problem" in a different sense, without realizing it. And they have been repeatedly committing the major error in problem solving — namely, jumping to conclusions about the cause of a problem. For

example, Polk says the "basic problem" is lack of discipline in the shop, and he assumes that this problem is the cause of the excessive rejects. On the other hand, Coggins sees one problem as the need for training, which he says is the cause for low morale, and he sees another problem as lack of communications, which he assumes caused Farrell's blunder; while Burger views all these failings and assumed causes as part of one big "problem of managing this entire plant."

These confusions in meaning are apparent to Luane because he has learned to distinguish problems from decisions. He sees any problem as a deviation from some standard or norm of desired performance. And to him a decision is now always a choice among various ways of getting a particular thing done or accomplished. Thus he recognizes that Coggins is really talking about a decision when he says that "our real problem is the need to train supervisors." Similarly, Luane realizes that Burger's "whole problem" is not a mere collection of failures and causes, but a statement describing his responsibility for making decisions as head of the plant. So Luane tries to clarify some of this confusion.

LUANE: I suggest we agree on what we mean by a problem so we can concentrate on that, and not worry right now about any decisions or any causes. The simplest way to solve a problem is to think of it as something that's wrong, that's out of kilter, something we want to fix. If we identify that for sure, then we can begin to look for what caused it; and when we've found the cause, then we can get into decision making, which is choosing the best way to correct the cause.

BURGER: But it isn't that simple, is it? We want to correct a lot of things around here, and they're usually mixed up together.

LUANE: Yes, but you can't work on them all at once, and you can't solve a lot of problems by correcting just one of them.

BURGER: OK, let's go along with Tom on this, but I personally think there are times when you can solve a lot of problems by solving one key problem.

LUANE: I think you'll find that the key problem is almost always at the end of a chain of other problems and causes. That is, the cause of one problem is itself a problem, and its

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cause is another problem, and the cause of that other problem is still another problem to be solved, and so on. It's kind of a stair-stepping sequence. Usually, if you correct the *cause* of the *basic* problem in such a sequence, the other problems and their causes will automatically disappear.

POLK: I'll buy that. If we correct the lax discipline in the shop, we'll correct the reject problem and those labor troubles, too.

LUANE: Not necessarily. You've got to be certain they're connected in a problem-cause sequence. It's safer to assume that they're not connected, and then pick the problem that's most important and start analyzing from there.

BURGER: All right, let's pick our most important problem and get on with this. Obviously the high reject rate on those panels is our biggest problem now. If we don't get it solved fast, at the present rate of rejects we'll be fouling up more than 2,500 panels every shift, and we can't stand for that.

POLK: That's for sure, Oscar, but after we jack up the supervisors and the press operators, and get the reject rates back in line, let's not forget to keep pushing for more discipline.

LUANE: Aren't you talking now about a decision, Bob — what should be done to keep things going as you think they should?

POLK: I guess so, by your definition, but it's damned important.

LUANE: I'm not doubting it, but we still haven't decided that the reject problem is our number one problem.

COGGIN: If you mean the biggest immediate problem, then I'll admit it's the rejects, but they're only symptoms of bigger, more fundamental problems, in my opinion.

BURGER: If we flop in delivering our quota of panels in this busy season, we can cost the company such a pile of money it makes me shudder.

LUANE: What if those reject rates on the panels keep rising?

POLK: Say, haven't we got it bad enough? You know that any rejects above 5% are very serious business. We've got to hold them below 2% — no "if's" or "but's" or we can shut up shop.

LUANE: OK, fair enough. I was just trying to make sure we had identified not only the most serious and urgent problem, but the one that could grow into real critical financial trouble.

COGGIN: I'm still convinced that our most important problem has to do with people, especially our headaches in training and helping them communicate.

BURGER: Be realistic, Ralph. If we don't correct this reject problem and produce what's required by Detroit, we may not be around to worry about *any* problems.

LUANE: Let's call this reject problem our number one problem. We can list the others, too, but give them less priority right now. Next, we've got to describe this reject problem precisely, and I mean *precisely*.

POLK: Oh, so they taught you to "define the problem first"? Sounds very familiar. Next you'll be telling us to "get all the facts." I've seen a lot of these step-by-step gimmicks, but I don't believe they really work.

LUANE: Matter of fact, getting all the information would just be a big waste of time. Only some of the facts would be useful to us. That's one reason I want to describe this problem precisely. Another reason is that we're going to use this specification to test any possible causes we find.

Outlining the Specification

Again let us see what these managers have been accomplishing. Luane has stated three basic concepts: a problem is a deviation from some standard of desired performance; a decision is a choice of the best way to correct the cause of a problem; and every problem has only one cause. He also has pointed out the stair-stepping process of going from one problem to its cause, which, in turn, may be a problem to be solved.

But the managers don't pay much attention to these ideas, and Polk clearly misunderstands stair-stepping, for he clings to the conclusion he earlier jumped to — that lax discipline is the cause of several problems. Industrial Relations Manager Coggin thinks "people problems" are fundamentally more important, but he accepts the priority his superiors give to the reject problem. At this point, Luane has tried to get the managers to think in terms of the urgency, seri-

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ousness, and growth trend of the problem. Having settled on the reject rate as the most important problem, they now are ready to start analyzing it.

LUANE: How would you describe this reject problem, Bob?

POLK: Why, I'd say the problem is that the reject rates are way out of line.

LUANE: How about you, Mr. Burger?

BURGER: Let's see. I'd say it was too many burred panels.

LUANE: And you, Ben? Haven't heard a peep out of you for some time now.

PETERS: I guess I'd go along with Bob on the reject rates being beyond tolerance.

LUANE: We'll have to get more specific. We're trying to describe this exactly. As an overall description, how about "Excessive rejects from burring on quarter panels"? Anyway, let's write that down for a starter. (He goes to an easel blackboard and writes these words out.) Now we have to dissect this problem in detail, getting specific facts about it in four different dimensions — *What, Where, When, and Extent*. (He writes these four words down on the left side of the blackboard.) What's more, we want to get two sets of facts opposite each of these dimensions — those that describe precisely what the problem *Is* and those that describe precisely what the problem *Is Not*. (He writes *Is* and *Is Not* at the top of two columns of blank space.)

POLK: What's all this for, anyway? Are we drawing a chart or something?

LUANE: Sort of a map. This is the specification worksheet, and the point is to fill the *Is* column with only those things directly affected by the problem. In the *Is Not* column we will put the things that are closely related to the problem but not affected by it. You'll see why we do this in a few minutes.

BURGER: OK, but I hope this doesn't take too long. Sounds kind of detailed to me.

LUANE: It's pretty simple, actually. Under *What*, we can first put down "burrs" as the deviation in this *Is* column, and "any other complaint" in the *Is Not* column, since, as I understand it, there are no other complaints reported

on these panels. But we can be more specific here, too. For instance, what did this deviation, "burrs," appear on? Were they on all kinds of panels?

POLK: No, Tom, just on the Panther panels, not the Cheetah panels.

LUANE: So we can put down, under *What*, the words "Panther panels" in the *Is* column, and "Cheetah panels" in the *Is Not* column. Got the idea?

POLK: I guess so, but it sounds a little too simple to me. Why bother?

LUANE: The point here is we're trying to separate what the problem *Is* from everything that *Is Not* the problem. We're aiming to draw a tight line around the problem, to describe it precisely, and later you'll see how this gives us the clues to the cause of the problem.

POLK: I hope so.

LUANE: Now we do the same thing for this *Where* section of the specification. Where was the deviation seen on the objects affected? Obviously, the burrs appeared on the Panther panels, so we put this down under *Is*. Also, where in the plant were the burrs observed?

BURGER: So far, only on lines #1, #2, and #4, but with Line #3 expected to go bad any minute.

LUANE: So under *Is* of this *Where* section we can put "lines #1, #2, and #4," and under *Is Not*, we can put "Line #3." Also, we have to fill in the *Is Not* opposite the words "Panther panels." Where didn't the burrs appear?

POLK: Nowhere else. We all know that.

LUANE: I know, but we've got to make this specification as accurate as possible. We can put down "other parts" under *Is Not*, since we know no other parts were affected.

POLK: I can't see where we're going with all this business.

BURGER: Neither can I, Bob, but let's let him finish.

LUANE: Now we come to the *When* part of this specification. Here we ought to be extra careful and get exact times, if possible. Ben, what times did those reject rates start going up yesterday morning?

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PETERS: You mean exactly? (*He consults his papers.*) On Line #2, the first excessive rejects showed up at 9:33 a.m.; on Line #1, they appeared at 10:18; and on Line #4, at 11:23 a.m. From those times on, each of these lines turned out rejects that were far above our tolerance of 2%.

LUANE: That's nice and precise. Can't tell, it may be important, so we'll put the exact times down. Now, how about the Is Not here? There were no burrs at all on lines #1, #2, and #4 before these times, and none at all on Line #3 at any time.

BURGER: I think I begin to see why you use those Is and Is Not columns. It's to put off to one side all the facts you aren't going to think about in solving this problem.

LUANE: No, that's not exactly why, but it will be clear as soon as we finish this specification. This last section, called *Extent*, covers the size of the problem — how big or serious it is, how many items are involved. We can put down "bad burring" and list the percentage of rejects on each line. Now what were those percentages, Ben?

PETERS (*consulting his papers again*): On Line #2, 11% rejects. On Line #1, 17.5%, and on Line #4, 15%. That's according to final counts last night.

LUANE: That leaves us only the Is Not column to fill in here, and this would cover the rejects on Line #3. We can say "Line #3 rejects" here, since they have stayed within the 2% tolerance. Now we've got the specification all filled in.

BURGER: Still looks like a simple collection of facts. Is that all there is to this system?

LUANE: No, Mr. Burger. Now we've got to begin analyzing this specification to dig out the cause of this problem.

POLK: You mean now we're finally going to start solving it?

Spotting the Distinction

Here we can briefly review what Luane has done in drawing up this specification. He followed a systematic outline to describe precisely both the problem and what lies outside the problem but is closely related to it. (See EXHIBIT 1 for Luane's specification worksheet.) The con-

trast between the Is and the Is Not not only draws a boundary around the problem, but strictly limits the amount of information needed for its solution. There is no need to "get all the facts" — only the relevant facts.

Note that Burger, Polk, and Peters all had different ways of describing the reject problem at first. Also, Burger thinks the specification looks too "detailed," while to Polk it sounds "too simple" at one point. The separation of the Is and the Is Not sounds strange to these managers because, like everyone else, they have learned to think in terms of similarities, not differences. This habit will bother them again a little further on in this problem analysis. Both Burger and Polk are impatient with this specification stage because they haven't yet seen the reasoning behind it.

A precise specification makes possible two logical steps toward finding possible causes of the problem, and after that, as Luane pointed out, it serves as a testing sheet to identify the most likely cause. Luane now turns to the specification on the board and introduces the managers to the most demanding part of this analytical process.

LUANE: We're ready now to use those contrasts between the Is and the Is Not of this specification. Whatever caused this problem produced only those effects we have described on the Is side; so if one thing is affected and another related thing is not, then there must be something distinctive or unique about the thing affected to set it apart from the other. If we know what is distinctive. . . .

BURGER (*interrupting*): I don't see any contrast between "burrs" and "any other complaint" in this specification, but I do see one between "Panther panels" and "Cheetah panels." I begin to get what you're driving at. The Panther panels are affected by the cause; the Cheetah ones aren't. We want to find out what sets the Panther panels apart from the Cheetahs, isn't that it?

LUANE: Yes, you look first for a sharp contrast between the Is and the Is Not, like the one you've spotted. Then we know there must be something distinctive about those Panther panels.

BURGER: Both panels are made from the same steel sheets, so the only way you could distinguish one from the other would be by its shape.

EXHIBIT I. SPECIFICATION WORKSHEET

| Deviation: Excessive rejects from burring on quarter panels | | | | |
|---|--|---|--|---------------------------------|
| | IS | IS NOT | WHAT IS DISTINCTIVE OF THE IS? | ANY CHANGE IN THIS? |
| WHAT Deviation Object | Burrs Panther panels | Any other complaint Cheetah panels | Deep draw | — |
| WHERE On object observed | Panther panels Lines #1, #2, & #4 | Other parts Line #3 | Deep draw | — |
| WHEN On object observed | Line #2 - 9:33 a.m. Line #1 - 10:18 a.m. Line #4 - 11:23 a.m. | Any burrs before { these times on Lines #2, #1, & #4 Line #3 at any time | Stacks of Zenith's blanks began to be used at these times | New alloy in Zenith steel |
| EXTENT How much How many | Bad burring (Line #2 - 11% rejects Line #1 - 17.5% " Line #4 - 15% " | Line #3 rejects | Reject rates not proportional to involvement in Farrell-Valenti conflict | |
| POSSIBLE CAUSES FOR TEST | A new alloy in Zenith's sheet steel is causing the excessive burring in the presses | | | |

The Panther panels are a deeper draw than the Cheetah panels.

LUANE: That's a distinction all right. We'll put down "deep draw" as a distinction in this *What* section of the specification. (*He writes the distinction off to one side of the blackboard.*) Now can you see any distinction in the *Where* section?

BURGER: I don't see any distinction there, like in the first case. Nothing distinctive of "Panther panels" as opposed to "other parts" that I can think of. Then you've got lines #1, #2, and #4 on the Is side and Line #3 on the Is Not side, and these lines are damned similar, except that Line #4 is a slow, old-time press. But that would only distinguish Line #4 from lines #1 and #2, which isn't what you're asking for.

LUANE: No, we don't want a distinction like that, between things that are together on the Is

side. We're looking for what sets the Is apart from the Is Not.

POLK: How about saying that Panther panels are distinctive of those three lines on the Is side? Line #3 makes only Cheetah panels, as we said a moment ago.

LUANE: We can put it down if we want to, but it's really a contrast we already have in our specification, and not a distinction. It's the same contrast we have here in the *What* section between Is and Is Not. What we want is something that really sets lines #1, #2, and #4 apart from Line #3.

POLK: Then the only distinction you have there is that same "deep draw," as we said before.

LUANE: I agree. We'll put it down again in this *Where* section. Let's go and see what distinction we can find in the *When* section, where we put down the different times that the burrs showed up on lines #1, #2, and #4.

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POLK: How about saying those times are all distinctly in the morning, not the afternoon?

LUANE: But how does that make them distinct from Line #3, where there are no times given at all? We're looking for something distinctive associated with those times.

PETERS: Wait a minute! I've got a hunch those times have something to do with the stacks of blanks delivered to the presses. I remember Adams on Line #1 told me late yesterday that the bad burrs began on his line just after using up the four stacks of blanks his area had been loaded with in the morning. And another thing — maybe those high-speed presses are just right for the shallow-draw panel that Dawson's line is stamping, but not quite right for the deep-draw Panther panels.

POLK: Come on, Ben, slow down! You know Henschel's Line #4 has an old, slow press, and he's getting a lot of burrs, so the speed can't be causing the rejects.

PETERS: Not just the speed, Bob, but the speed in combination with the deep-draw panels.

LUANE: Let's stick to this specification job and not jump to conclusions. I'm not knocking your hunches, Ben, for I've found they can often be useful, providing you hold them aside until you start looking for possible causes. We can make a note of them so we won't forget them later. (*He writes off to one side of the specification, "Burring times connected with using up the stacks of blanks," and "Press speed and deep draw combine to make burrs."*)

POLK: I don't think Ben's hunch on press speeds and draws is any good, in any case. Engineering told me a while ago that they spent a lot of time examining the presses at various speeds and never found any stamping defects traceable either to press speeds or to the depth of draw.

PETERS: But how about the combination of speeds and different draws? Bob, I think you've got too much confidence in Engineering.

LUANE: Can we get back to this specification? Does anyone see any distinction in this *When* section?

BURGER: I think Ben has a point there about the stacks of blanks on Line #1 being used up just before the bad burring started. How about the other lines?

PETERS: I don't know, but we can find out.

LUANE: Will it take long?

PETERS: No, just a phone call. (*He reaches for the phone, gets his assistant on the line, and asks him to check the times when lines #2 and #4 used up the stacks of blanks they started out with the morning before.*)

LUANE: While we're waiting, let's look for distinctions in this last section of *Extent*.

POLK: Don't see any, unless it's that "deep-draw" distinction again.

LUANE: As I see it, the distinction would have to be in those rates of burring we put down here, not in the panels or the presses.

BURGER: Well, you could say that the rates of burring on lines #1, #2, and #4 don't correspond very well with the ways those lines were involved with that Farrell-Valenti quarrel. I mean, Farrell's Line #2 ought to show the most burrs, and actually it shows less than the other two lines.

COGGIN: Maybe the reason is that the men on lines #1 and #4 are really sorrier than the men on Farrell's line. Maybe Valenti has more friends on the other two lines. You can't distribute and measure feelings with percentage points, like you can with those reject figures.

LUANE: Sorry to have to remind you again, Ralph, but that's jumping to a conclusion about the cause. We'd better not do this until we've finished with this specification.

COGGIN: Well, I can't just sit here and let the rest of you ignore the human side of this problem. When are we going to get to that, anyway?

LUANE: We'll take it up if this analysis leads us in that direction. It hasn't yet. So let's put down that distinction connected with the different rates of rejects and the different degrees of involvement with the Valenti affair. We can call this distinction, "Reject rates not proportional to involvement in Valenti conflict."

PETERS (*reading a note his assistant has just brought in to him*): Here are those times we asked for. Line #2 used up its stacks of Tuesday blanks at 9:30 a.m. yesterday, and Line #4 at 11:20 a.m. That checks out, as I thought. The bad burrs started on all these lines just

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after they started using stacks of blanks delivered to the floor Wednesday morning.

LUANE: Looks like that gives us a distinction for the *When* section. We can call it, "Stacks of Tuesday's blanks used up at these times."

POLK: But how about Line #3? Ben, did your man get the time that Dawson's line finished using its supply of Tuesday's blanks?

PETERS: Yes. At 8:30 yesterday morning.

POLK: And no bad burring started on Line #3, so what's the importance of this distinction?

LUANE: We can't tell yet, Bob, but we'll just put it down for now. That seems to complete our distinctions, unless anyone sees any more in this specification. If not, we can proceed to look for the possible causes of this problem.

Seeking the Cause

At this point these managers have presumably collected all the relevant information that describes their problem precisely and have dug out those distinctive things in the Is facts that are characteristic marks of the problem. But they had trouble spotting the distinctions, as Luane expected. Also, one of them, Peters, introduced a couple of hunches into the discussion, exhibiting a tendency to "feel" that things are connected somehow or are important.

Note that Luane does not completely discourage such hunches, only recommends they be set aside until later. But note, too, that Peters' reasoning about his first hunch is faulty, as Polk quickly points out, while his second hunch is simply another example of jumping to a conclusion about the cause, as Luane points out. It is Burger who seems to be the sharpest here in spotting a distinction, after stumbling at first. By this time apparently only Industrial Relations Manager Coggin is still interested in the "human side of the problem," as he puts it, but his job is, of course, most directly concerned with this angle.

Luane, by keeping the discussion on the specification, prevents a time-wasting digression. He also warns Polk against prematurely judging the last distinction (about using up Tuesday's blanks) as useless just because it doesn't seem to fit in with another fact in the specification — that is, the absence of serious burrs on Line #3.

Now Luane introduces the managers to a concept that lies at the heart of problem analysis,

the concept that the cause of every problem is a change of one kind or another.

LUANE: The distinctions we've gotten out of the specification give us the areas where we can look for possible causes of these burred panels. Let's look for any changes we can find in any of the distinctions. What's new or different in these distinctions? We probably won't find many. Maybe only one.

BURGER: Do you mean any kind of change?

LUANE: No, only those changes which have occurred within one of these areas of distinction, or have had an effect on one of them. We can start with that distinction of "deep draw."

POLK: I can't believe that a change is always the cause of a problem. It can be any little thing, or some goof-off, or bonehead action.

LUANE: Maybe those things go along with the cause, but I think we'll find here that these burred panels are being caused by some change. Also, Mr. Burger, I meant to point out that we don't want to go looking for everything that's changed, or we'll be here all day. There are things changing all over the plant all the time. But what we want to find is any change that's in one of these areas of distinction.

POLK: I'm not convinced, and what's more I don't see anything changed in that "deep draw" distinction. The deep draw is standardized on all three presses making it, and has been for months.

LUANE: OK, so there's no change there. But what about that distinction we were going to check out in the *When* section? What's changed about those "stacks of Tuesday's blanks used up at these times"? Anything new or different about these stacks?

PETERS: Well, the shift from Tuesday's blanks to Wednesday morning's blanks would be a change.

LUANE: That sounds like a real change to me. Wednesday's stacks are the new blanks the lines started to work on just before the burring started.

BURGER: If that's the cause of these rejects, how do you figure it? I can see that if Wednesday's blanks were different in some way from Tuesday's, that might make them the cause of the rejects.

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LUANE: Let's hold off on possible causes until we're sure there aren't some more changes in these distinctions.

POLK: I can't see any more changes. I say let's get on with it and start looking for possible causes.

LUANE: OK, if you want to, but are we sure there's not some change connected with that other distinction in the *Extent* section, which we put down as "rates not proportional to involvement in Valenti conflict"?

BURGER: I don't see anything new or different there, unless it's the differences between those rates themselves.

LUANE: I can't either, so let's go ahead and check that possible cause you suggested a moment ago, when you said yesterday's blanks might be the cause of the excessive burrs. But we should test this possible cause, not just rationalize ourselves into accepting it. If this possible cause fails to explain all the facts in this specification — that is, both the facts on the *Is* side and those on the *Is Not* side — then we can be sure it's not the actual cause. Because the actual cause would have produced exactly all those things that we put down as *Is* in the specification, and also would explain those things we put down as *Is Not*.

BURGER: I assume this is what you meant when you said earlier that the specification would be used in testing the possible causes?

LUANE: That's right. We can start testing against the *What* of the specification by asking, "Does the use of yesterday's blanks explain the fact that the excessive burrs appear on the Panther panels and not on the Cheetah panels?"

POLK: No, of course it doesn't. Line #3 started using Wednesday's blanks even before the other lines did, and it still hasn't produced excessive burrs on the Cheetah panels.

LUANE: Well then, there goes your possible cause. It doesn't fit the first facts in our specification's *Is* and *Is Not*. We'll have to toss it out.

BURGER: You mean we've got to find a possible cause that accounts for every fact in this specification?

POLK: That's what the man said, Oscar. But now where does this leave us? We've run out of the only change we could find.

LUANE: What this means is that our specification isn't really complete. We must have missed something somewhere. We'll have to go back and sharpen up our facts if we can.

Respecifying the Problem

We can pause briefly here to point out that Luane himself was responsible for the unsatisfactory results of this first search for the cause of the problem. When he accepted the change that Burger suggested — that is, the change to Wednesday's blanks just before the bad burring started — Luane didn't think to ask about the difference between Tuesday's and Wednesday's blanks. A shift from one day's blanks to another's is not a change if the blanks are identical. Polk saw this at once, of course, and torpedoed this possible cause, as he should have. But this error of Luane's might not have occurred if he had been more careful earlier, as we shall now see.

LUANE: We can go back and look over our *Is* and *Is Not* facts in the specification, but these look pretty accurate and precise to me. I think we probably missed a distinction or change.

PETERS: What about those hunches of mine? You said we might come back to them.

LUANE: That's an idea. What was it you said? We wrote them down over here somewhere. Here's one, "Press speed and deep draw combine to make burrs."

POLK: That's no good, as I said before. Engineering checked that thoroughly.

LUANE: Well, here's Ben's other hunch, "Burring times connected with using up the stacks of blanks."

BURGER: We just tested that one out and got nowhere.

PETERS: Hold everything! I think we skipped a point. We talked about yesterday's blanks, but those aren't just yesterday's blanks — they're also blanks from a new supplier, Zenith. I missed this point because we'd made some parts with the Zenith metal before we ever put it in production, and it worked fine. Besides, Zenith's metal met all our specifications. We checked the blanks again when the excessive burring first occurred yesterday, and they looked perfect going through the blander. So we

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dropped this as a possibility, especially when the labor trouble looked so hot.

LUANE: Then that means we should change that distinction in the *When* section of our specification to "Stacks of Zenith's blanks began to be used at these times."

POLK: How will that help? Dawson's Line #3 is also using Zenith blanks, and there's no burring there.

LUANE: That's jumping to a conclusion about the cause. Let's look for a change in this revised distinction. Is there anything new or different about Zenith's sheet steel? How long have we been using it?

POLK: We signed the contract a month ago.

PETERS: Yes, but we didn't get delivery right off. The first shipment didn't actually get here until two days ago.

COGGIN: Matter of fact, Ben, we didn't get those Zenith sheets until late Tuesday. I know, because one of the men got hurt unloading them that evening. He wasn't familiar with the way Zenith blocks the sheets for shipment.

LUANE: Let's concentrate on what's new or different in Zenith's sheets.

PETERS: I think they're just the same as we got from our other sheet-steel suppliers.

LUANE: Are you sure?

PETERS: Pretty sure. We specified a slightly different alloy for Zenith's sheets, but not enough different to matter.

LUANE: Well, anyway, the new alloy is a change in an area of distinction. What is distinctive about those burring times is that stacks of new metal began being used then, and the change here is that a slightly different metal is going into the presses. We can state the possible cause this way — "A new alloy in Zenith's sheet steel is causing the excessive burring in the presses."

BURGER: Ben just said he thinks the alloy change wasn't enough to matter.

LUANE: I know he did, but it was a change in an area of distinction, so it's a possible cause. We can test it against the facts in the specification. Could this change — the slightly different alloy — explain the appearance of excessive burrs in the Panther panels, but not in the Cheetah panels?

COGGIN: No, it couldn't, because the Cheetah panels aren't having trouble with excessive burrs.

POLK: Hold it a moment! Maybe the alloy could explain it. It just dawned on me that Engineering did say something about those Cheetah panels a couple of months back. Something about how their shallow draw would make it easier to use a tougher alloy in the blanks. That could mean the Panther panels are fouling up on these Zenith blanks with the new alloy! Let's check it! (*He picks up the phone and calls Engineering, which immediately confirms his hypothesis.*) Engineering says the new alloy in the Zenith sheets makes the Panther panels much more likely to burr than the Cheetah panels.

LUANE: Looks like you've found it, Bob. We could go on and test this out against the rest of the specification, but I'd say you've probably discovered the most likely cause of the excessive burrs. I suggest you have Engineering verify this.

POLK: That's easy. We can do it before lunch right on the lines.

BURGER: What if we find this "most likely cause" isn't the answer?

LUANE: Then we'll have to respecify all over again, sharpen up the facts even more, and look for other distinctions and changes. But it looks like we've really spotted the change that's causing the trouble. In this case, the new alloy is the change, the metal supplied by Zenith is the distinction, and the deep draw on lines #1, #2, and #4 is another, added distinction. In other words, the most likely cause turned out to be a change *in* a distinction *plus* a distinction.

COGGIN: You mean, Tom, we've got to go through this whole business every time in order to solve every problem?

LUANE: If you don't know the cause of the problem for sure, I'd say yes. There may be some times when you can spot a change in some facts about a problem right off and hit the cause at once. Sometimes you can just go through the process mentally, for it tells you the relevant questions to ask about every problem. But you'd better check any possible cause out carefully, and you really can't check completely unless you have a complete specification of the problem in front of you. If you don't check a possible cause this way, you may be taking action

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on something that's not the cause at all, and waste more time than if you had specified and analyzed the problem in the first place.

BURGER: Sounds logical enough. But what if you can't find a distinction or change?

LUANE: If you can't find any distinction or change in your specification, then you have to dig that much harder. And at least you know where to probe. A distinction *has* to be there if the problem exists, because whatever went wrong affected some things in a certain way, and did not affect other closely related things. There's got to be at least one distinction between these two kinds of things — the Is and the Is Not — and there's got to be a change that works through this area of distinction to cause the problem.

BURGER: I see what you mean. Anyway, if Engineering can verify this alloy change in Zenith's sheets as the cause of those excessive rejects, I'll be damned glad. My face would sure have been red if we went ahead with those decisions I came in here with this morning, all based on the assumption that the men were to blame for the high reject rates! And it all seemed so reasonable! Now, if this alloy change is actually the cause, all we'll have to do is shift back to sheets with the old alloy formula.

COGGIN: But there's still that labor problem we haven't touched yet. When do we get around to analyzing that Farrell-Valenti trouble for a solution? And we've still got to calm Patella down somehow.

POLK: I think those problems don't need to be analyzed. We know what touched off the Farrell-Valenti trouble; we know why Patella is giving us trouble. What's got to be done now is to make some decisions. All that's needed is some straight talk. Tell the men the facts and to get on with the job, and tell Patella to pipe down or you'll report him for attempted sabotage.

BURGER: Wait a minute, Bob. Maybe we'd better first try to analyze that Farrell-Valenti trouble a little more systematically. There could be something else to it. Tom, why not take

a crack at it and then let me know what you come up with? Meanwhile, Bob, you'd better make some arrangements to start reclaiming those rejects as fast as possible. We'll need them all if Detroit asks us for what I think they will.

The meeting ends with Burger and Polk leaving together, the others following them out.

Conclusion

In these concluding exchanges we see that the analysis has clearly uncovered a cause which none of the managers were thinking of when they began, and which was actually verified as the cause. Note that the clue to the change that caused the trouble did not appear until Luane went back to the specification and sharpened up one of the distinctions. It was the point about Zenith's steel sheets that finally jogged Polk into recalling the possible effects of a deep draw on blanks made of the new alloy. Had Luane been more expert in the Kepner-Tregoe analysis procedure, the respecification might not have been necessary.

As it was, this solution turned out to be one of the more difficult kinds — for it involved, as Luane pointed out, a change in a distinction *plus* a second distinction. This second distinction was an essential condition (the deep draw) that had to occur before the particular change (the new alloy) could take effect and burr the panels.

Without a precise specification and careful analysis, only time-wasting guesswork and luck could have arrived at the most likely explanation of this problem. More important, this analysis prevented the Plant Manager from taking action that could have produced a more serious problem than the one he was trying to solve. Also, it should be noted that the managers did not automatically become expert problem-analyzers in going through this experience. They are still likely to jump to conclusions, as Polk did toward the end when he quickly prescribed actions to be taken on Coggins's labor problems without knowing their causes. It takes time to change a manager's thinking habits into a systematic approach to problem analysis.

Sherlock Holmes: "It's quite a three-pipe problem."

— Sir Arthur Conan Doyle

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